RUGGEDCOM®
INDUSTRIAL STRENGTH NETWORKS™

RuggedSwitch®
RSG2300

32-Port Managed Ethernet Switch with 4 Modular Gigabit Uplink Ports
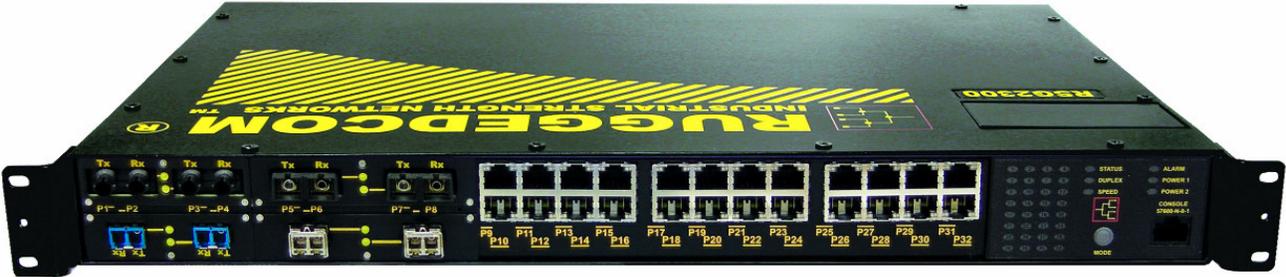
Installation Guide
November 12, 2008

www.ruggedcom.com

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We have checked the contents of this manual against the hardware and software described. However, deviations from the description cannot be completely ruled out.

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Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference on his own expense.

CAUTION

This product contains a laser system and is classified as a **"CLASS 1 LASER PRODUCT"**

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Changes or modifications not expressly approved by RuggedCom Inc. could void the user's authority to operate the equipment.

Should this device require service see the "Warranty and Service" section of this guide.

IMPORTANT

This product should be installed in a **restricted access location** where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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1 Product Overview

1.1 Functional Overview

The RuggedSwitch® RSG2300 is an industrially hardened, fully managed, modular Ethernet switch specifically designed to operate reliably in electrically harsh and climatically demanding utility substation and industrial environments. The RSG2300's superior ruggedized hardware design coupled with the embedded Rugged Operating System (ROS™) provides improved system reliability and advanced cyber security and networking features, making it ideally suited for creating Ethernet networks for mission-critical, real-time, control applications.

The RSG2300's modular flexibility offers 1000BaseX fiber and 10/100/1000BaseTX copper port combinations. Optional front or rear mount connectors make the RSG2300 highly versatile for any application and can support multiple fiber connectors (SFP, GBIC, LC, SC) without loss of port density. The RSG2300 is packaged in a rugged galvanized steel enclosure with industrial grade DIN, panel, or 19" rack-mount mounting options.

1.2 Feature Highlights

Ethernet Ports

- 24 10/100TX copper ports
- Optional: up to 4 1000LX Gigabit Ethernet ports (copper and/or fiber) and up to 8 100FX Fiber Fast Ethernet ports
- Non-blocking, store and forward switching
- 2 port modules for tremendous flexibility
- Fiber types supported include multimode, singlemode, and bidirectional single strand
- Full compliance with IEEE: 802.3, 802.3u & 802.3z
- Full duplex operation and flow control (IEEE 802.3x)
- Fiber optic connectors supported: ST, MTRJ, LC, SC
- Pluggable Optic module support: SFP, GBIC
- Long haul optics allow Gigabit distances up to 90km

Cyber Security Features

- Multi-level user passwords
- SSH/SSL encryption
- MAC-based port security
- Selective port enable/disable
- Port-based network access control using IEEE 802.1x
- VLAN support (IEEE 802.1Q) to segregate and secure network traffic
- RADIUS centralized access management
- SNMPv3 featuring encrypted authentication and session

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RuggedRated™ for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
  - Zero-Packet-Loss™ Technology
  - Meets IEEE 1613 Class 2 (electric utility substations)
  - Exceeds IEC 61850-3 (electric utility substations)
  - Exceeds IEEE 61800-3 (variable speed drive systems)
  - Exceeds IEC 61000-6-2 (generic industrial environment)
  - Exceeds NEMA TS-2 (traffic control equipment)
- -40 to +85°C operating temperature (no fans)
- Conformal coated printed circuit boards (optional)
- 18 AWG galvanized steel enclosure
- Hazardous Location Certification: Class 1 Division 2

Universal Power Supply Options

- Fully integrated, dual-redundant (optional) power supplies
- Universal high-voltage range: 88-300VDC or 85-264VAC
- Popular low voltage DC ranges: 24VDC (9-36VDC), 48VDC (36-72VDC)
- Screw or pluggable terminal blocks for reliable, maintenance-free connections
- CSA/UL 60950 safety approved to +85°C

Rugged Operating System (ROS™) Networking Features

- Simple plug and play operation: automatic learning, negotiation, and crossover detection
- MSTP (Multiple Spanning Tree Protocol) support: IEEE 802.1Q-2005
- RSTP (Rapid Spanning Tree Protocol) support: IEEE 802.1w
- eRSTP™ (Enhanced Rapid Spanning Tree) support, <5ms network fault recovery
- QoS (Quality of Service) support: IEEE 802.1p, for real-time traffic
- Port rate limiting and broadcast storm limiting
- VLAN (Virtual LAN) support: IEEE 802.1Q with double tagging
- GVRP (GARP VLAN Registration Protocol) support: IEEE 802.1D
- IGMP Snooping for multicast filtering
- GMRP (GARP Multicast Registration Protocol) support: IEEE 802.1D
- Link Aggregation support: IEEE 802.1ad
- Loss of link management on fiber ports
- Port configuration, status, statistics, mirroring, security
- SNTP time synchronization (both client and server)
- Industrial automation features (e.g. Modbus)

Rugged Operating System (ROS™) Management Features

- Secure Web-based management interface
- Console menu and Command Line management interfaces via SSH, RSH, and Telnet
- SNMP v1, v2c, and v3
- RMON (Remote MONitoring)
- Rich set of diagnostics with logging and alarms

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1.3 Mounting Flexibility

RSG2000 series products have been designed with maximum mounting and display flexibility. Customers can order an RSG2000 series switch that can be mounted in a standard 19" rack, 1" DIN Rail, or directly onto a panel. For rack mount installations, the RSG2000 series can be ordered with connectors on the front panel or on the rear of the chassis. Placing the connectors on the rear allows all data and power cabling to be installed and connected at the rear of the rack. See Figure 1 and Figure 2 for examples of rack mount orientation.
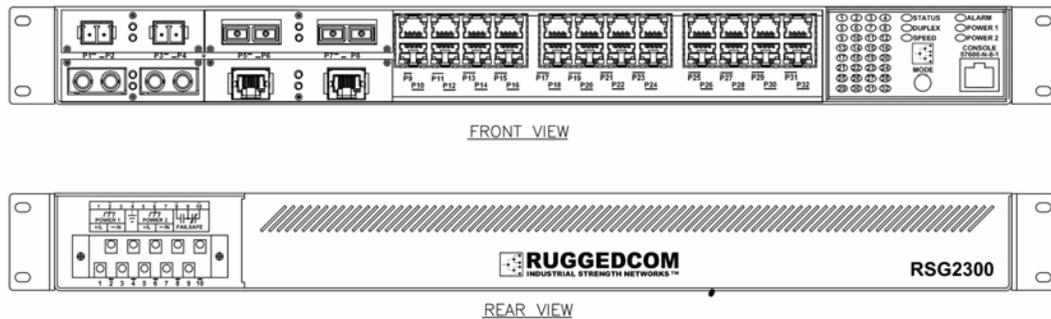
Figure 1: 19" Rack Front Mount (connectors at front)
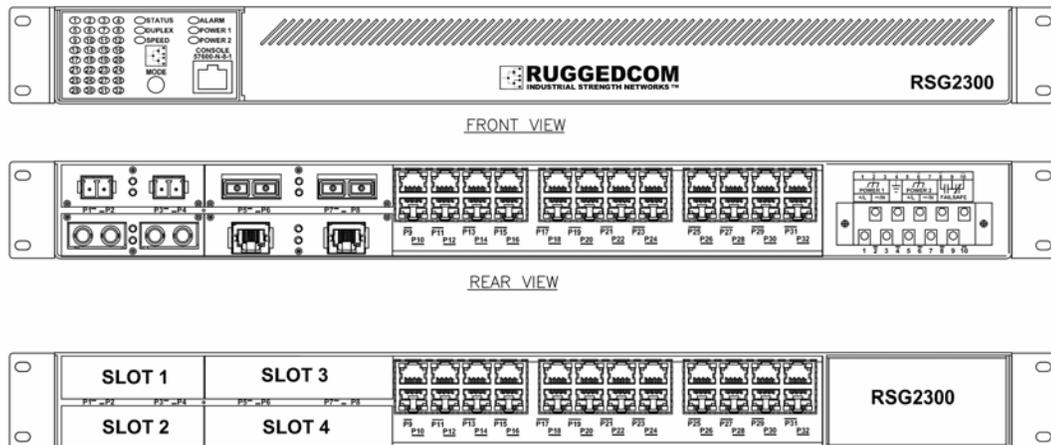
Figure 2: 19" Rack Rear Mount (connectors at rear)

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1.4 Ethernet Panel Description

The Ethernet connector panel of the RSG2300 is organized into three banks of eight 10/100Tx copper ports, for a total of 24 fixed 10/100Tx ports, and four modular slots, whose configuration may be selected at the time the unit is ordered. Figure 3 shows the physical layout of these ports.
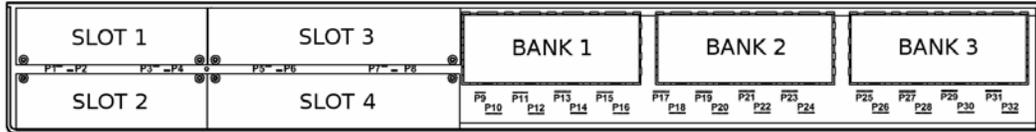
Figure 3: RSG2300 Ethernet Port Layout

Slots 1 and 2 support two-port fiber or copper modules up to 100Mbps, and Slots 3 and 4 support two-port modules up to 1Gbps. Section 3.5 lists and provides specifications for the fiber optic interfaces available for the RSG2300. The complement of modules that is installed on a particular unit may be determined by reading the factory data file via the RuggedSwitch® ROS™ user interface.

Each two-port Ethernet module is equipped with an LED per port that indicates link/activity status information. The LED is solid for ports with a valid link, and blinks for activity. Figure 4 shows a copper port module in slot 1 and a fiber module in slot 2 along with the associated link/activity LEDs for each port.
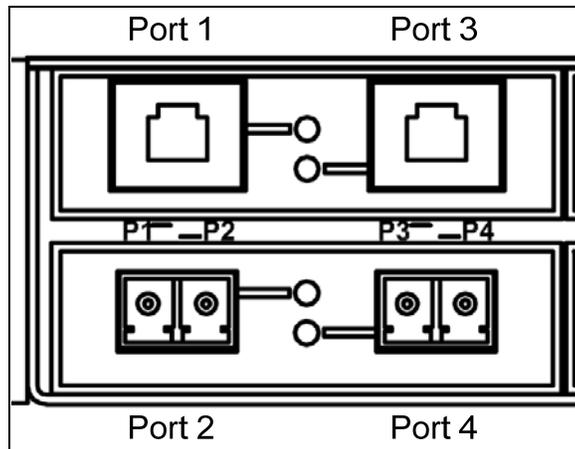
Figure 4: Ethernet panel LEDs

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1.4.1 Fiber Optic Transceiver Orientation and Connection

Depending on the order code of the product, the RSG2300 can be equipped with several different types of fiber optic ports. The Transmit (TX) and Receive (RX) connections of each port must be properly connected and matched for proper link and operation. Modules populated on the top row of the device typically have locking mechanisms or tabs facing the top of the unit. Modules located on the bottom row of the device have locking mechanisms or tabs facing the bottom of the unit.

The diagrams in this section depict each fiber connector style supported by the RuggedSwitch® in order to provide a reference for the proper orientation of cable connections. A front view (looking into the connector) and a top view of the connector module are shown for each one. Note that if modules are populated on the bottom row of the device, the transceiver orientation will be inverted relative to the diagram (i.e. RX and TX will be reversed).

Figure 5 and Figure 6 show front and top views of the pluggable fiber transceiver modules supported by RuggedSwitch®. Note that when the module is installed in the unit, most of the body of the module as shown in top views below will not be visible.

Table 1: Pluggable Fiber Transceiver Modules

Figure 5: 1000LX SFP (mini-GBIC) Module and LC connector
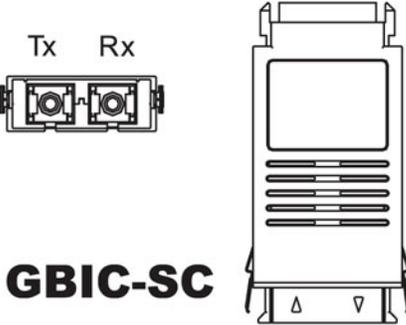
Figure 6: 1000LX GBIC connector

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Figure 7 through Figure 11 show front and top views of the fixed fiber transceiver modules supported by RuggedSwitch®. Note that when the daughter card containing transceiver modules is installed in the unit, most of the body of the module as shown in top views below will not be visible.

Table 2: Fixed Fiber Transceivers

Figure 7: 10FL ST connector	**Figure 8: 100FX MTRJ connector**
Figure 9: 1000LX LC connector	**Figure 10: 1000LX SC connector**
Figure 11: 1000LX ST connector	
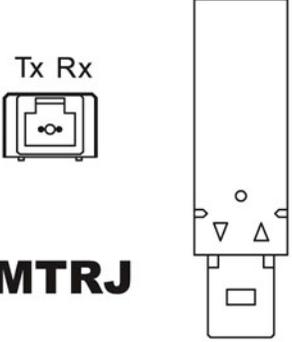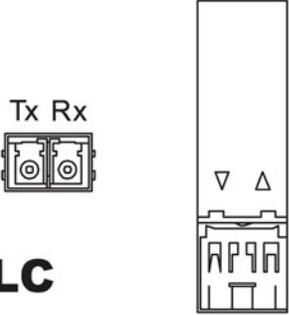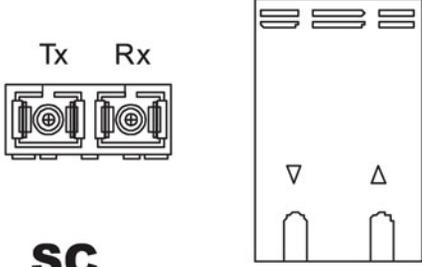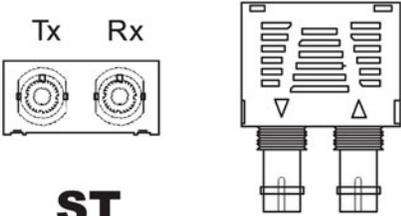
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1.5 Display Panel Description

RSG2000 series products are equipped with a versatile display panel, shown in Figure 12, which provides real-time status information for each port and for the chassis as a whole, to allow simple diagnostics and troubleshooting. It features:

- RS232 console port for 'out of band' console access and configuration
- Power supply and Alarm status indicators
- Convenient port status indicators conveying Link/Activity, Duplex, or Speed via the Mode push-button (toggles between the three display modes)
- System reset via the Mode push-button (if held for 5 seconds)
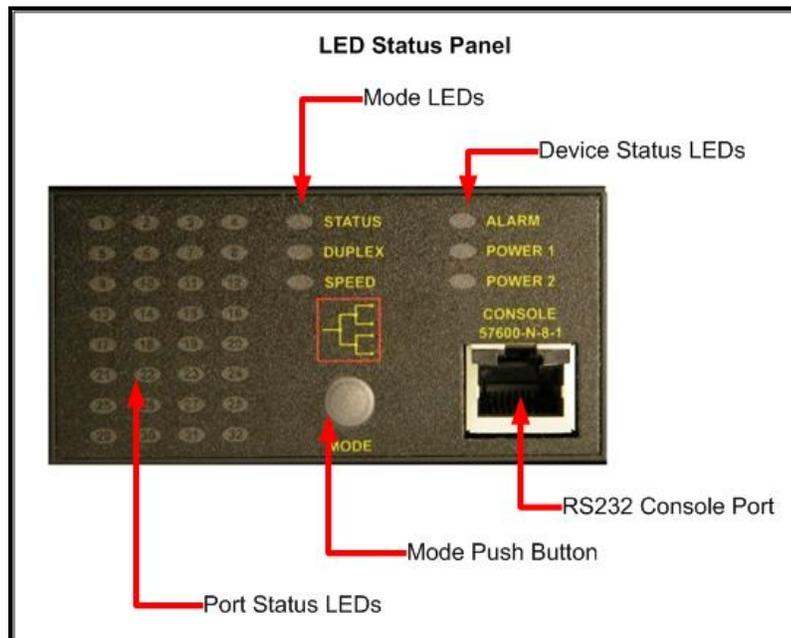
Figure 12: RSG2300 LED Display Panel

The device status LEDs provide a quick visual indication of the operational status of the unit. Table 3 lists the possible LED colors and their corresponding descriptions.

LED	Color	Description
PS1 / PS2	Green	Power supply operating normally
	Red	Power supply failure
	Off	No power supply installed
Alarm	Red	An alarm condition exists – log in to the web management interface or to the CLI to determine the alarm code
	Off	No alarms exist

Table 3: LED Display – Device status LED behavior definition

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The port LEDs can be cycled between three display modes: Status, Duplex, and Speed. Pushing the Mode button causes the display mode to be cycled.

Mode	Color	Description
Status	Green (Solid)	Link detected
	Green (Blinking)	Activity
	Off	No link
Duplex	Green (Solid)	Full-Duplex operation
	Orange (Solid)	Half-Duplex operation
	Off	No link
Speed	Green (Blinking)	1000Mb/s
	Green (Solid)	100Mb/s
	Orange (Solid)	10Mb/s
	Off	No link

Table 4: Port Status LED behavior definition

2 Installation

2.1 Rack Mounting

The RSG2000 family of products can be rack mounted using the included rack mount adapter assemblies shown in Figure 13. Secure the rack mount adapter to the front side of the chassis using the included black PAN head Philips screws in the positions shown in Figure 14. The entire chassis can then be mounted to a standard 19" rack. An additional two rack mount adapters are included to optionally secure the rear of the chassis in high-vibration or seismically active locations.
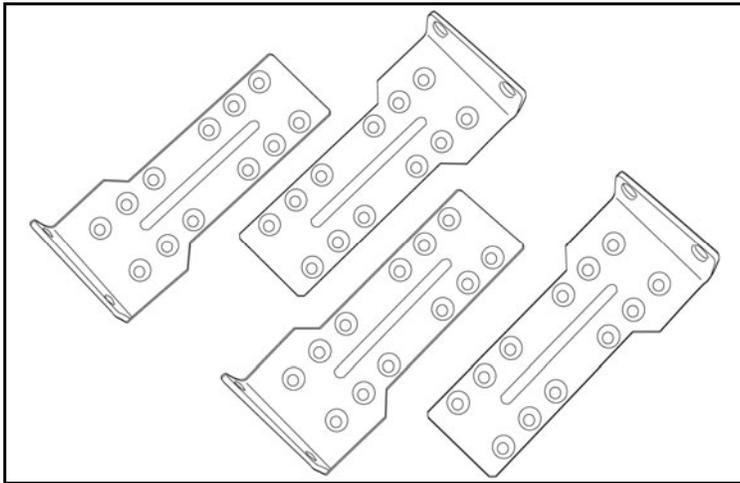
Figure 13: RSG2000 Family 19" Rack Mount Adapters
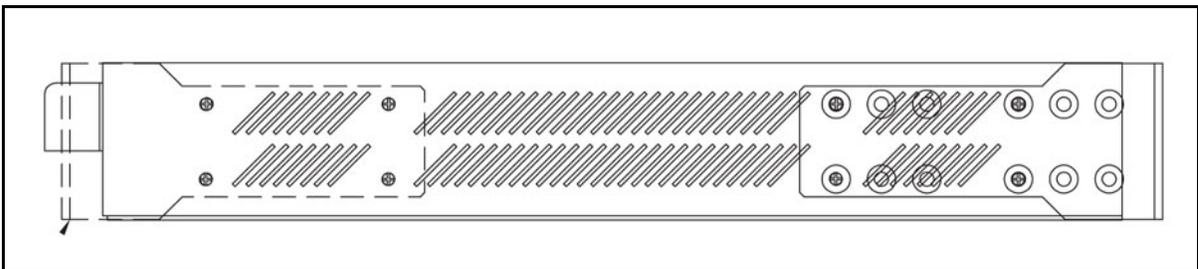
Figure 14: Rack mount adapter mounting location

Note:

Since heat within the RSG2300 is channeled to the enclosure, it is recommended that 1 rack-unit of space (1.75") be kept unpopulated and free of equipment above each RS2000 series product to allow for a small amount of convectional airflow. Although forced airflow is not necessary, any increase in airflow will result in a reduction of ambient temperature that will improve the long-term reliability of all equipment mounted within the rack space.

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2.2 Panel and DIN Rail Mounting

RSG2000 series products can be ordered as panel/DIN mount chassis. Both options involve the use of the panel/DIN adapters to be mounted on each side of the chassis enclosure. The adapter allows for the chassis to be mounted on a standard 1" DIN rail using the grooves in the adapter, and secured using the included Philips screw. See Figure 15 for a PANEL/DIN mounting diagram.
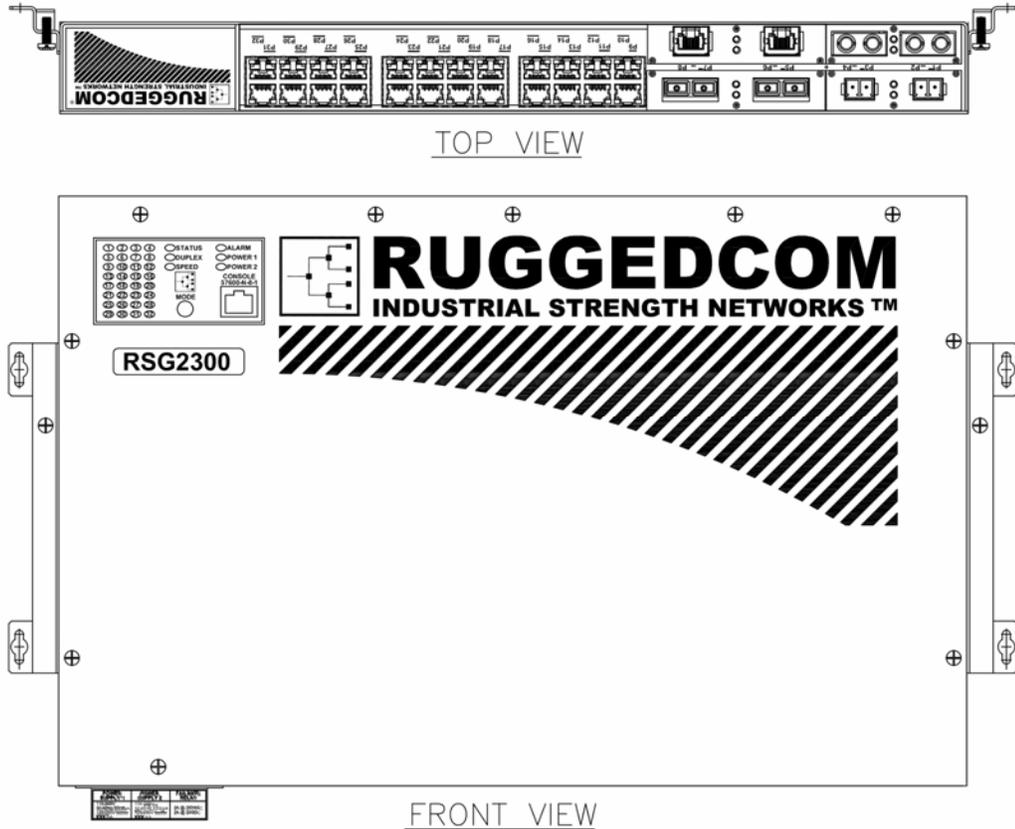
Figure 15: RSG2300 Panel / DIN RAIL mounting diagram (connectors at top)

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2.3 Power Supply Wiring and Grounding

The RSG2000 family supports dual redundant power supplies, "Power Supply 1" (PS1) and "Power Supply 2" (PS2). The connections for PS1, PS2 and the fail-safe relay are located on the terminal block as shown in Figure 16 and Figure 17.

RSG2000 products can be equipped with either a Philips Screw Terminal Block or a Phoenix Plug Terminal Block. The Philips Screw Terminal Block has Philips screws with compression plates, allowing either bare wire connections or crimped terminal lugs. We recommend the use of #6 size ring lugs to ensure secure, reliable connections under severe shock or vibration. Both terminal blocks have a safety cover which must be removed via two Phillips screws before connecting any wires. The safety cover must be reattached after wiring to ensure personnel safety. Refer to Table 5 below for a description of each terminal as well as to sections 2.3.1 through 2.3.3 for power supply wiring examples.
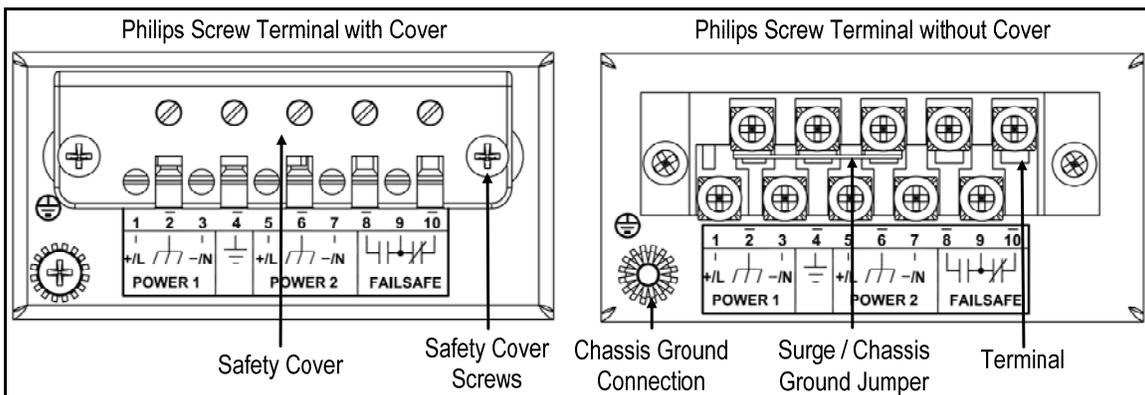
Figure 16: RSG2000 Series Philips Screw Terminal Block
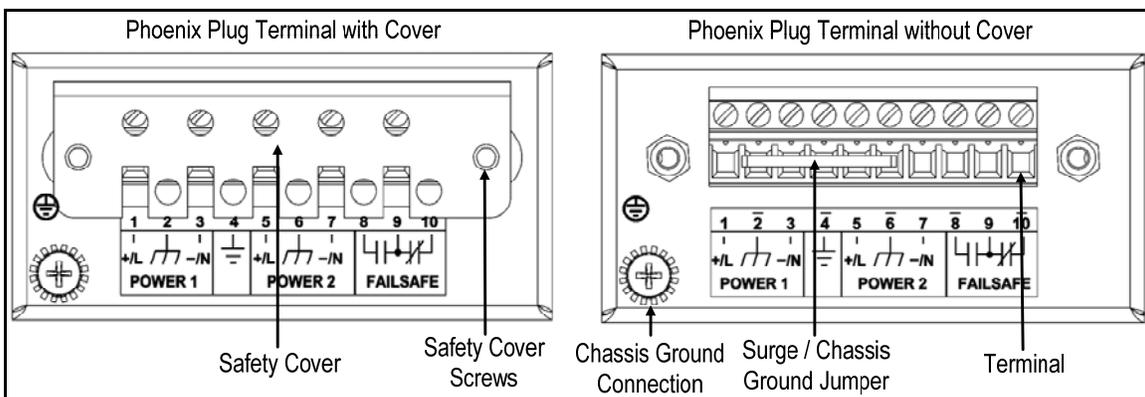
Figure 17: RSG2000 Series Phoenix Plug Terminal Block

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Installation

The RSG2000 Family chassis ground connection, shown in Figure 18, uses a #6-32 screw. It is recommended to terminate the ground connection in a #6 ring lug, and to use a torque setting not exceeding 15 in·lbs (1.7 Nm).
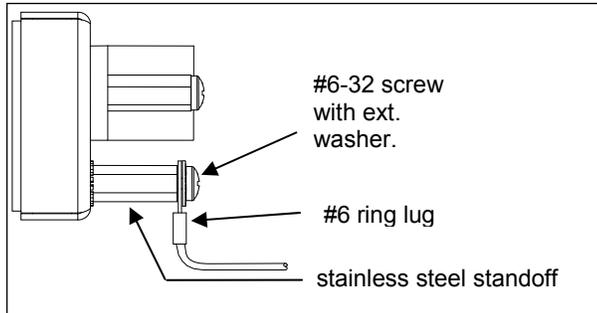
Figure 18: Chassis Ground Connection

Terminal Number	Description	Usage
1	PS1 Live / +	**PS1 Live / +** is connected to the positive (+) terminal if the power source is DC or to the (Live) terminal if the power source is AC.
2	PS1 Surge Ground	**PS1 Surge Ground** is connected to the Chassis Ground via a jumper on the terminal block. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry. *NOTE: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing.*
3	PS1 Neutral / -	**PS1 Neutral / -** is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
4	Chassis Ground	**Chassis Ground** is connected to the Safety Ground terminal for AC inputs or the equipment *ground bus* for DC inputs. Chassis ground connects to both power supply surge grounds via a removable jumper.
5	PS2 Live / +	**PS2 Live / +** is connected to the positive (+) terminal if the power source is DC or to the (Live) terminal if the power source is AC.
6	PS2 Surge Ground	**PS2 Surge Ground** is connected to the Chassis Ground via a jumper on the terminal block. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry. *NOTE: Surge Ground must be disconnected from Chassis Ground during HIPOT (dielectric strength) testing.*
7	PS2 Neutral / -	**PS2 Neutral / -** is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
8	Relay NO Contact	Normally open, failsafe relay contact.
9	Relay Common	Failsafe relay common contact.
10	Relay NC Contact	Normally closed, failsafe relay contact.

Table 5: RSG2000 Series Power terminal block connection description

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2.3.1 AC Power Supply Wiring Examples
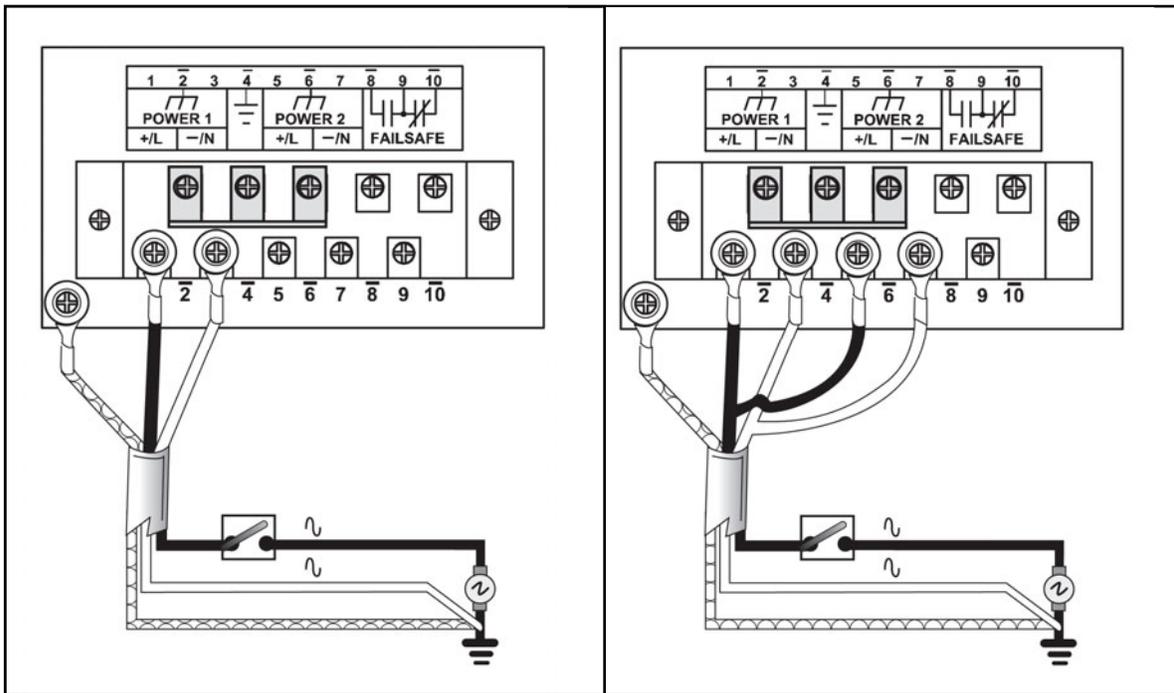
Figure 19: AC Power supply wiring examples

Notes:

- 125/230VAC rated equipment: A 250VAC appropriately rated circuit breaker must be installed.
- Equipment must be installed according to the applicable country wiring codes.
- When equipped with two HI voltage power supplies, independent AC sources can be used to power the product for greater redundancy.

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2.3.2 DC Power Supply Wiring Examples
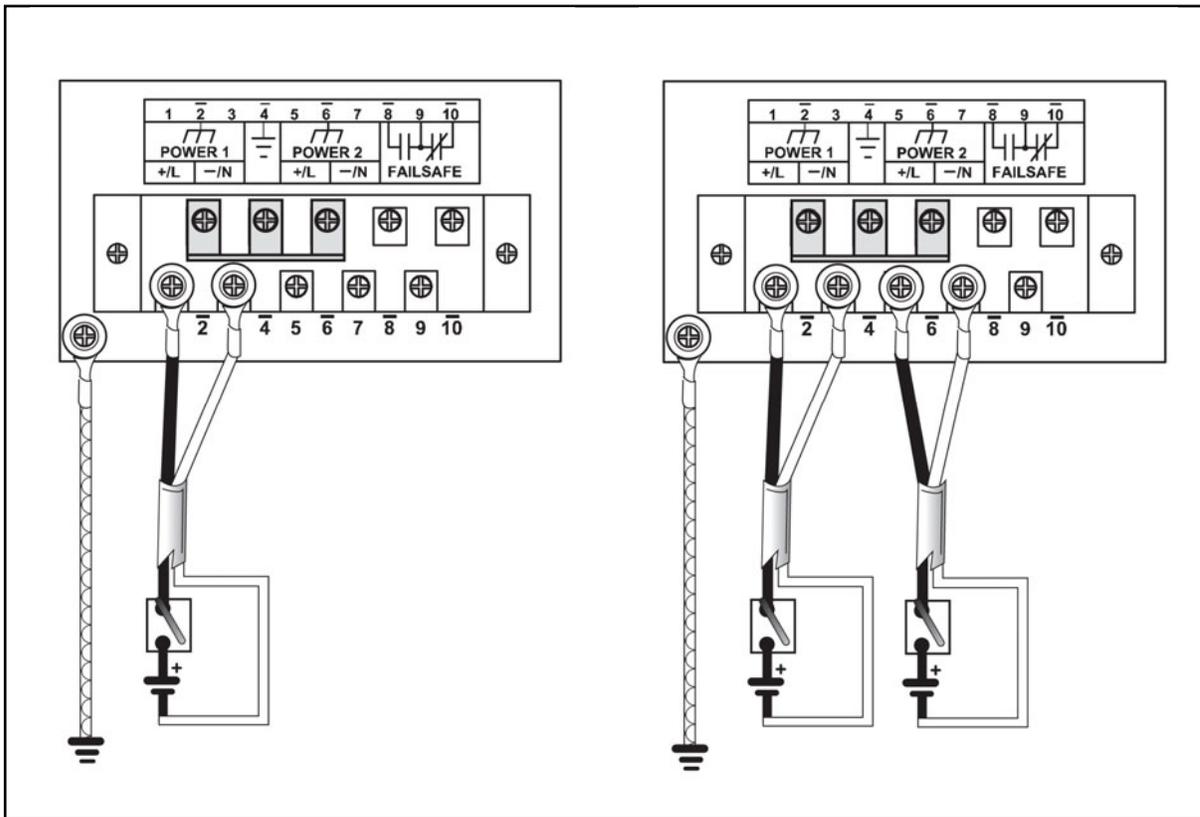
Figure 20: DC Power supply wiring examples

Notes:

- 125/250VDC rated equipment: A 300VDC appropriately rated circuit breaker must be installed.
- A circuit breaker is not required for 12-24 or 48 VDC rated power supplies.
- For dual DC power supplies, separate circuit breakers must be installed and separately identified.
- Equipment must be installed according to the applicable country wiring codes.

2.3.3 Dual Power Supplies – DC and AC Inputs
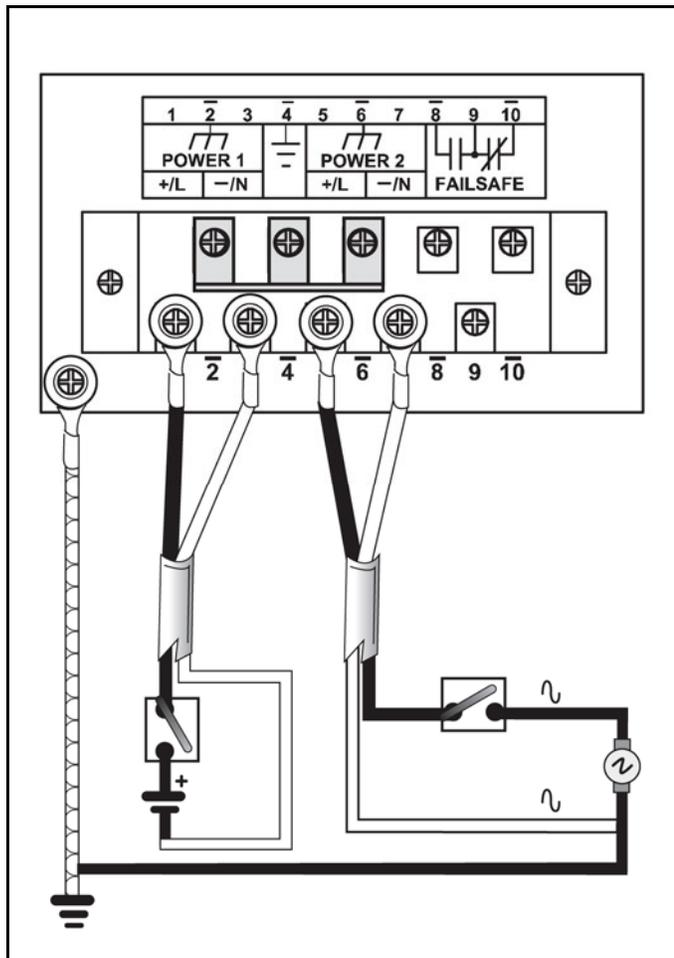
Figure 21: DC And AC power supply wiring examples

Notes:

- 125/250VDC rated equipment: A 300VDC appropriately rated circuit breaker must be installed.
- 110/230VAC rated equipment: A 250VAC appropriately rated circuit breaker must be installed.
- A circuit breaker is not required for 12-24 or 48VDC rated power supplies.
- Separate circuit breakers must be installed and separately identified.
- Equipment must be installed according to the applicable country wiring codes.

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2.4 Dielectric Strength (HIPOT) Testing

For dielectric strength (HIPOT) testing in the field, users must remove the metal jumper located across terminals 2, 4, and 6 of the power supply terminal block. This metal jumper connects transient suppression circuitry to chassis ground and must be removed in order to avoid damage to transient suppression circuitry during HIPOT testing. Figure 22 shows the proper HIPOT test connections and should be followed to avoid damage to the device.
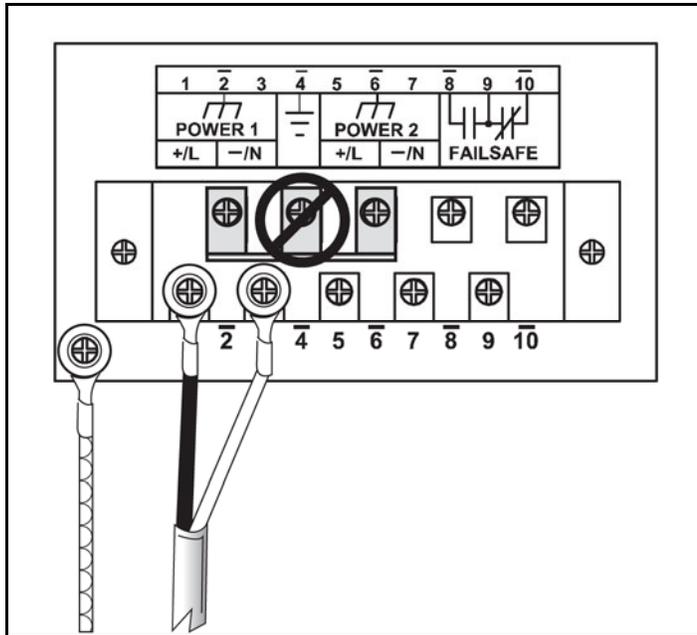
Figure 22: Dielectric Strength (HIPOT) Testing

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2.5 Failsafe Alarm Relay Wiring and Specifications

The "Failsafe" output relay is provided to signal critical error conditions that may occur on RS2000 series products. The contacts are energized upon power-up of the unit and remain energized unless a critical error occurs. The proper relay connections are shown in Figure 23. Control of this output is user selectable and can be programmed via the Rugged Operating System (ROS). One common application for this output is to signal an alarm if a power failure or removal of control power occurs.
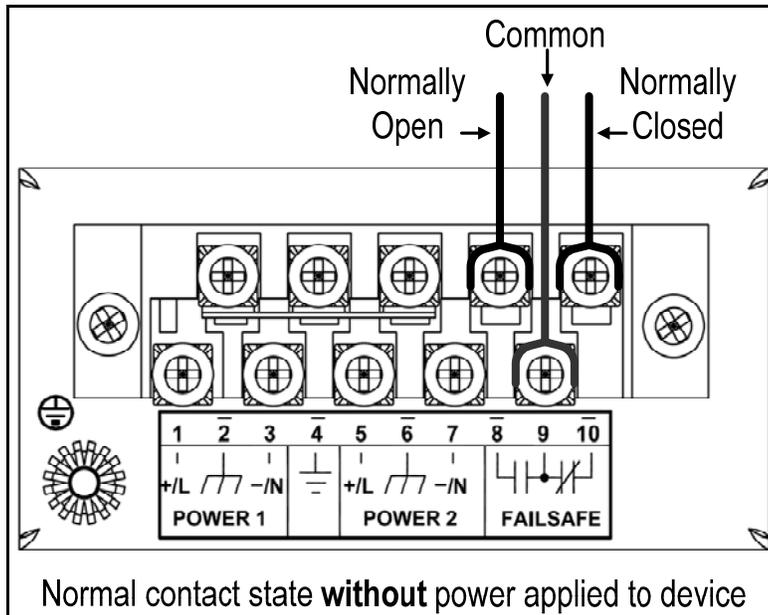
Figure 23: Failsafe Alarm Relay Wiring

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2.6 Console Port Wiring

An RS232 console port for configuration and management of the device is located on the LED display module shown in Figure 24. This port is intended to be a temporary connection during initial configuration or troubleshooting and allows for direct serial access to the management console. The connection is made using the DB9-Female to RJ45 console cable included in the device packaging shown in Figure 25. Console connection settings are: 57600 bps, no parity bits, 8 data bits, and 1 stop bit.
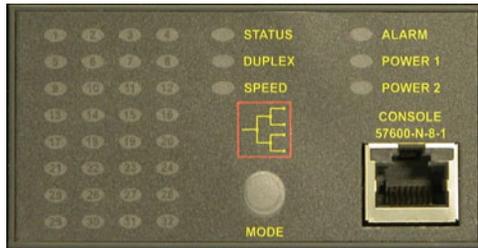
Figure 24: Console port on display board
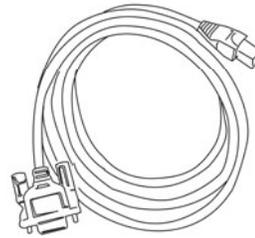
Figure 25: RSG2000 Series Console cable

For reference, the console cable pin-out is show in Table 6.

RuggedCom RS232 over RJ45 pin-out specification		
Signal Name (PC is DTE)	*DB9- Female*	*RJ45 Male*
DCD – Carrier detect	1	2
RxD – Receive data (to DTE)	2	5
TxD – Transmit data (from DTE)	3	6
DTR – Data terminal ready	4	3
GND - Signal ground	5	4
DSR – Data set ready	6	1*
RTS – Ready to send	7	8
CTS – Clear to send	8	7
RI – Ring Indicator	9	1*

Table 6: RS232 over RJ45 console cable pin-out

After initial configuration, the RSG2300 can be configured via a number of networked mechanisms such as Telnet SSH, and the built-in secure web server. Consult the ROS™ User Guide for further details.

Notes:
- This port is not intended to be a permanent connection.
- Serial cable must not exceed 2m (6.5 ft) in length.

2.7 Gigabit Ethernet 1000Base-TX Cabling Recommendations

The IEEE 802.3ab Gigabit Ethernet standard defines 1000 Mbit/s Ethernet communications over distances of up to 100 meters using all 4 pairs in category 5 (or higher) balanced unshielded twisted-pair cabling. For wiring guidelines, system designers and integrators should refer to the Telecommunications Industry Association (TIA) TIA/EIA-568-A wiring standard that characterizes minimum cabling performance specifications required for proper Gigabit Ethernet operation. To ensure reliable, error-free data communication, new and pre-existing communication paths should be verified for TIA/EIA-568-A compliance. Table 7 summarizes the relevant cabling standards.

Cabling Category	1000BaseTx Compliant	Required action
<5	No	New wire infrastructure required
5	Yes	Verify TIA/EIA-568-A compliance
5e	Yes	No action required. New installations should be designed with Category 5e components or higher
6	Yes	No action required
>6	Yes	Connector and cabling standards to be determined.

Table 7: Cabling categories and 1000BaseTx compliance defined.

Follow these recommendations for copper data cabling in high electrical noise environments:

- Data cable lengths should be as short as possible, ideally limited to 3m (10ft) in length. Copper data cables should not be used for inter-building communications.
- Power and data cables should not be run in parallel for long distances, and ideally should be installed in separate conduits. Power and data cables should intersect at 90° angles when necessary to reduce inductive coupling.
- Shielded/screened cabling can optionally be used. The cable shield should be grounded at a single point to avoid the generation of ground loops.

Note: RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during a transient event communication errors or interruptions may occur but recovery is automatic. RuggedCom also does not recommend using these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

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2.8 Pluggable optics – Installation, removal, and precautions

The RSG2300 can be ordered with two pluggable optical form factors: SFP (Small Form-factor Pluggable), and GBIC (GigaBit Interface Converter). SFP and GBIC modules can be safely inserted and removed while the chassis is powered and operating – a feature also referred to as "hot-swappable". Nevertheless, when inserting or removing optics there are several precautions that should be taken. They include:

- Ensuring that dust caps are mounted on SFP cages at all times unless a user is in the process of inserting or removing an SFP module. The dust caps will prevent the accumulation of residue or particles that might inhibit proper operation.
- Ensuring that the user has properly discharged any possible electrostatic build-up in order to prevent electrostatic discharges (ESD). This can be accomplished by properly grounding via an ESD wrist strap, or by touching earth or chassis ground before performing installation or removal of optics. ESD can damage or shorten the life of optical modules when not plugged into a chassis.
- Ensuring that SFP and GBIC optical modules are always stored in an ESD-safe bag or other suitable ESD-safe environment, free from moisture and stored at the proper temperature (–40 to +85°C).
- Disconnecting all cables from the SFP or GBIC module prior to insertion or removal of the module.
- Using only optics certified by RuggedCom Inc. with RuggedCom products. Damage can occur to optics and product if compatibility and reliability have not been properly assessed.

2.8.1 Module Insertion – GBIC and SFP

Special attention must be paid to the orientation of SFP and GBIC modules upon installation in the RuggedSwitch® chassis. For example, Figure 26 shows the proper orientation of SFP modules installed to both upper and lower slots. Modules on the upper row must be inserted top-side up, and modules on the lower row must be inserted top-side down. SFP modules should be inserted with the bail-latch in the locked position.
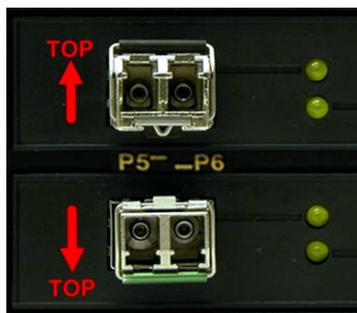
Figure 26: SFP Orientation for top and bottom row ports

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Both SFP and GBIC modules should gently slide into their ports and should lock in place when fully inserted. Dust covers should be in place when installing the modules, and should always be in place when cables are not connected. Diagrams of both SFP and GBIC modules are provided in Table 1 as a guide to the orientation of each type.

2.8.2 GBIC Module Removal

GBIC modules have two locking latches, one on either side of the module, as shown in Figure 27. To remove a GBIC module, disconnect any cables and replace the dust cover to protect the optics. Depress both latches simultaneously and gently pull the module from the chassis. The module should be immediately stored in an ESD-safe environment.
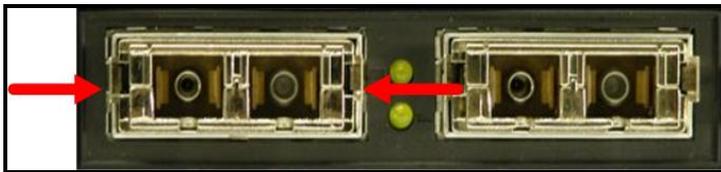
Figure 27: Locking latch location on GBIC optical modules

2.8.3 SFP Module Removal

SFP Modules are removed using the metal bail latch located on the top of the module as shown in Figure 28. To remove the SFP module, disconnect any cables and replace the dust cover to protect the optics. Grasp the bail latch and gently pull outwards to unlock and remove the module. Removal of an SFP module is shown further in Figure 29. The module should be immediately stored in an ESD-safe environment.

Figure 28: SFP Bail Latch Location
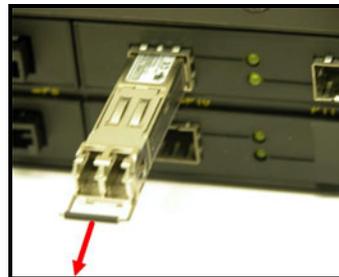
Figure 29: SFP Removal

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3 Technical Specifications

3.1 Power Supply Specifications

Power Supply Type	Input Range		Fuse Rating	Max. Power Consumption[3]
	Min	*Max*		
12 – 24 VDC	10 VDC	36 VDC	6.3A(F)[2]	25W
48 VDC	36 VDC	59 VDC	2A(T)[2]	
HI (125/250 VDC)[1] HI (110/230 VAC)[1]	88 VDC 85 VAC	300 VDC 265 VAC	2A(T)[1,2]	

Notes:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse
3. Power consumption varies based on configuration. 10/100Base-TX ports consume roughly 1W less than fiber optic ports
4. For continued protection against risk of fire, replace only with same type and rating of fuse.

3.2 Failsafe Relay Specifications

Parameter	Value (Resistive Load)
Max Switching Voltage	240VAC, 125VDC
Rated Switching Current	2A @ 240VAC 0.15A @ 125VDC, 2A @ 30VDC
Max Switching Capacity	150W, 500VA

3.3 Networking Standards Supported

Parameter	10Mbps Ports	100Mbps Ports	1000Mbps Ports	Notes
IEEE 802.3	✓			10BaseT / 10BaseFL
IEEE 802.3u		✓		100BaseTX / 100BaseFX
IEEE 802.3z			✓	1000BaseSX/LX
IEEE 802.3ab			✓	1000BaseTx
IEEE 802.3x	✓	✓	✓	Full Duplex Operation
IEEE 802.1D	✓	✓	✓	MAC Bridges
IEEE 802.1Q	✓	✓	✓	VLAN (Virtual LAN)
IEEE 802.1p	✓	✓	✓	Priority Levels

3.4 Copper Ethernet Port Specifications

The RSG2300 features a fixed set of three fixed banks of eight 10/100Tx copper ports each, and can be ordered with additional 10/100Tx ports in slots 1 and 2, and 10/100/1000Tx ports in slots 3 and 4. All copper ports have the following specifications:

Parameter	Specification	Notes
Speed	10/100/1000 Mbps	Auto-negotiating; 1000Mbps modules supported in slots 3 & 4 only
Duplex	FDX / HDX	Auto-negotiating
Cable-Type	> Category 5	Shielded/Unshielded
Wiring Standard	TIA/EIA T568A/B	Auto-Crossover, Auto-polarity
Max Distance	100m	
Connector	RJ45	
Isolation	1.5kV	RMS 1-minute

3.5 Fiber Ethernet Port Specifications

Sections 3.5.1 through 3.5.3 list specifications of the optical transceivers used in the dual-port modules available for the RSG2300. The specifications are organized by signaling speed and then by order code. Module order codes are contained within each product when assembled and configured at the factory. Consult the RuggedCom ROS™ User Guide for help in obtaining the factory configuration data.

3.5.1 10FL Ethernet Optical Specifications

Order Code	Mode	Connector Type	Cable Type (um)	Tx λ (typ.) (nm)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
FL01	MM	ST	62.5/125	820	-16	-9	-34	-11.2	2	18
			50/125		-19.8	-12.8				14.2

3.5.2 Fast Ethernet (10/100Mbps) Optical Specifications

Order Code	Mode	Connector Type	Cable Type (um)	Tx λ (typ.) (nm)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
FX01	MM	ST	62.5/125	1308	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX02	MM	SC	62.5/125	1308	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5
FX11	MM	LC	9/125	1310	-19	-14	-32	-14	2	13
FX03	MM	MTRJ	62.5/125	1308	-19	-14	-31	-14	2	12
			50/125		-22.5					8.5

FX04	SM	ST	9/125	1310	-15	-8	-32	-3	20	17
FX05	SM	SC	9/125	1300	-15	-8	-31	-7	20	16
FX06	SM	LC	9/125	1310	-15	-8	-34	-7	20	19
FX07	SM	SC	9/125	1310	-5	0	-34	-3	50	29
FX08	SM	LC	9/125	1310	-5	0	-35	-3	50	30
FX09	SM	SC	9/125	1310	0	5	-37	0	90	37
FX10	SM	LC	9/125	1310	0	5	-37	0	90	37

3.5.3 Gigabit Ethernet (1000Mbps) Optical Specifications

Fixed Gigabit Transceivers

Order Code	Mode	Connector Type	Cable Type (um)	Tx λ (typ.) (nm)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
FG02	SM	SC	9/125	1310	-10	-3	-20	-3	10	10
FG03	SM	LC	9/125	1310	-9.5	-3	-21	-3	10	11.5
FG04	SM	SC	9/125	1310	-5	0	-20	-3	25	15
FG05	SM	LC	9/125	1310	-7	-3	-24	-3	25	17

SFP Gigabit Transceivers

Order Code	Mode	Connector Type	Cable Type (um)	Tx λ (typ.) (nm)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
F51[3]	MM	LC	50/125	850	-9	-2.5	-20	0	0.5	11
			62.5/125						0.3	
FG52	SM	LC	9/125	1310	-9.5	-3	-19	-3	10	9.5
FG53	SM	LC	9/125	1310	-7	-3	-23	-3	40	16
FG54[4]	SM	LC	9/125	1550	0	5	-23	-3	70	23

GBIC Gigabit transceivers

Order Code	Mode	Connector Type	Cable Type (um)	Tx λ (typ.) (nm)	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Distance (typ.) (km)	Power Budget (dB)
FG71	SM	SC	9/125	1310	-9.5	-3	-21	-3	10	11.5
FG72	SM	SC	9/125	1310	-7	-3	-24	-3	25	17
FG73[5]	SM	SC	9/125	1550	0	5	-23	-3	70	23

Notes:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. All optical power numbers are listed as dBm averages.
3. F51 transceivers are rated for -10 to +85°C
4. FG54 transceivers are rated for 0 to +70°C
5. FG73 transceivers are rated for -25 to +85°C

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3.6 Type Test Specifications

3.6.1 IEEE 1613 (C37.90.x) EMI Immunity Type Tests

Test	Description		Test Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/- 8kV
		Enclosure Air	+/- 15kV
IEEE C37.90.2	Radiated RFI	Enclosure ports	35 V/m
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz
		D.C. Power ports	+/- 4kV
		A.C. Power ports	+/- 4kV
		Earth ground ports[1]	+/- 4kV
IEEE C37.90.1	Oscillatory	Signal ports	2.5kV common mode @1MHz
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz
		A.C. Power ports	2.5kV common, 1kV diff. mode@1MHz
IEEE C37.90	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)
		D.C. Power ports	5kV
		A.C. Power ports	5kV
IEEE C37.90	Dielectric Strength	Signal ports	2kVac
		D.C. Power ports	2kVac
		A.C. Power ports	2kVac

Note:

1. Only applicable to functional earth connections separated from the safety earth connection

3.6.2 IEC 61850-3 EMI Type Tests

TEST	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports[1]	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports[1]	10V	3

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IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
		A.C. Power ports	30% for 1 period, 60% for 50 periods	N/A
IEC 61000-4-11			100% for 5 periods, 100% for 50 periods	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV diff. mode@1MHz	3
		D.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	3
		A.C. Power ports	2.5kV common, 1kV diff. mode@1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kVac (Fail-Safe Relay output)	N/A
		D.C. Power ports	2kVac	N/A
		A.C. Power ports	2kVac	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

Note:
1. Only applicable to functional earth connections separated from the safety earth connection

3.6.3 Environmental Type Tests

Test	Description		Test Levels	Severity Levels
IEC 60068-2-1	Cold Temperature	Test Ad	-40°C, 16 Hours	N/A
IEC 60068-2-2	Dry Heat	Test Bd	+85°C, 16 Hours	N/A
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55°C , 6 cycles	N/A
IEC 60255-21-1	Vibration	Tests Fc	2g @ (10 - 150) Hz	Class 2[1]
IEC 60255-21-2	Shock	Tests Ea	30g @ 11mS	Class 2[1]

Note:

1. Class 2 refers to "Measuring relays and protection equipment for which a very high security margin is required or where the vibration levels are very high, e.g. for shipboard applications and for severe transportation conditions"

3.7 Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30cm radius surrounding the center of the enclosure.
Ambient Relative Humidity	5% to 95%	Non-condensing
Ambient Storage Temperature	-40 to 85°C	

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3.8 Mechanical Specifications

Parameter	Value	Comments
Dimensions	18.29 x 12.14 x 1.75 in (464.57 × 308.36 × 44.45 mm)	(Length x Width x Height) with mounting brackets installed
Weight	10 lb (4.5 kg)	
Enclosure	18AWG galvanized steel	
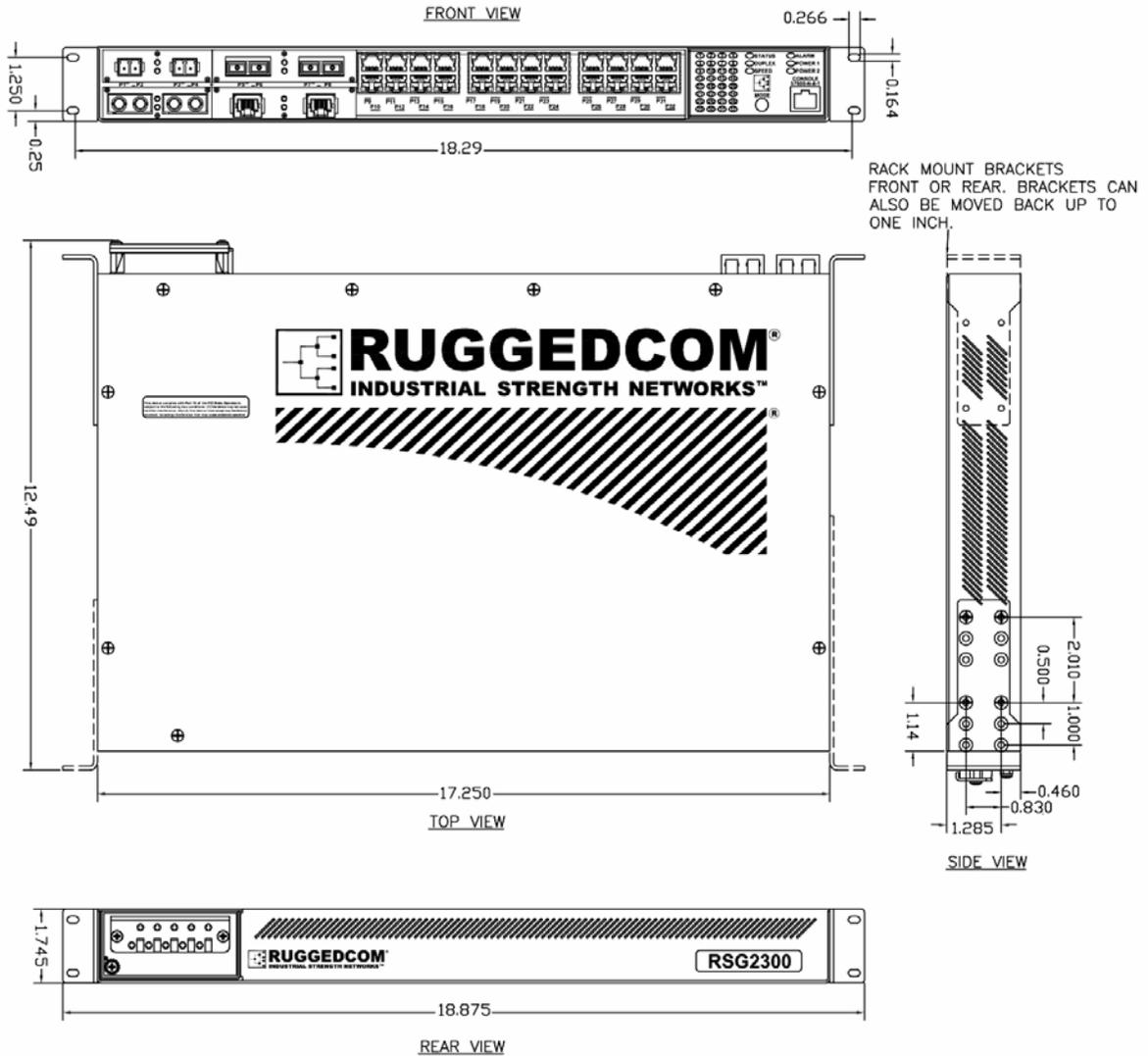
Figure 30: RSG2300 Mechanical Dimensions

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4 Agency Approvals

Agency	Standards	Comments
CSA	CSA C22.2 No. 60950, UL 60950	Passed
CE	EN 60950, EN 61000-6-2	CE Compliance is claimed via Declaration of Self Conformity Route
FCC	FCC Part 15, Class A	Passed
CISPR	EN55022, Class A	Passed
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Passed
IEC/EN	EN60825-1:1994 + A11:1996 + A2:2001	Passed

5 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit http://www.ruggedcom.com/ or contact your customer service representative.

Should this product require service, contact the factory at:

RuggedCom Inc.
30 Whitmore Road
Woodbridge, Ontario
Canada L4L 7Z4
Phone: (905) 856-5288
Fax: (905) 856-1995